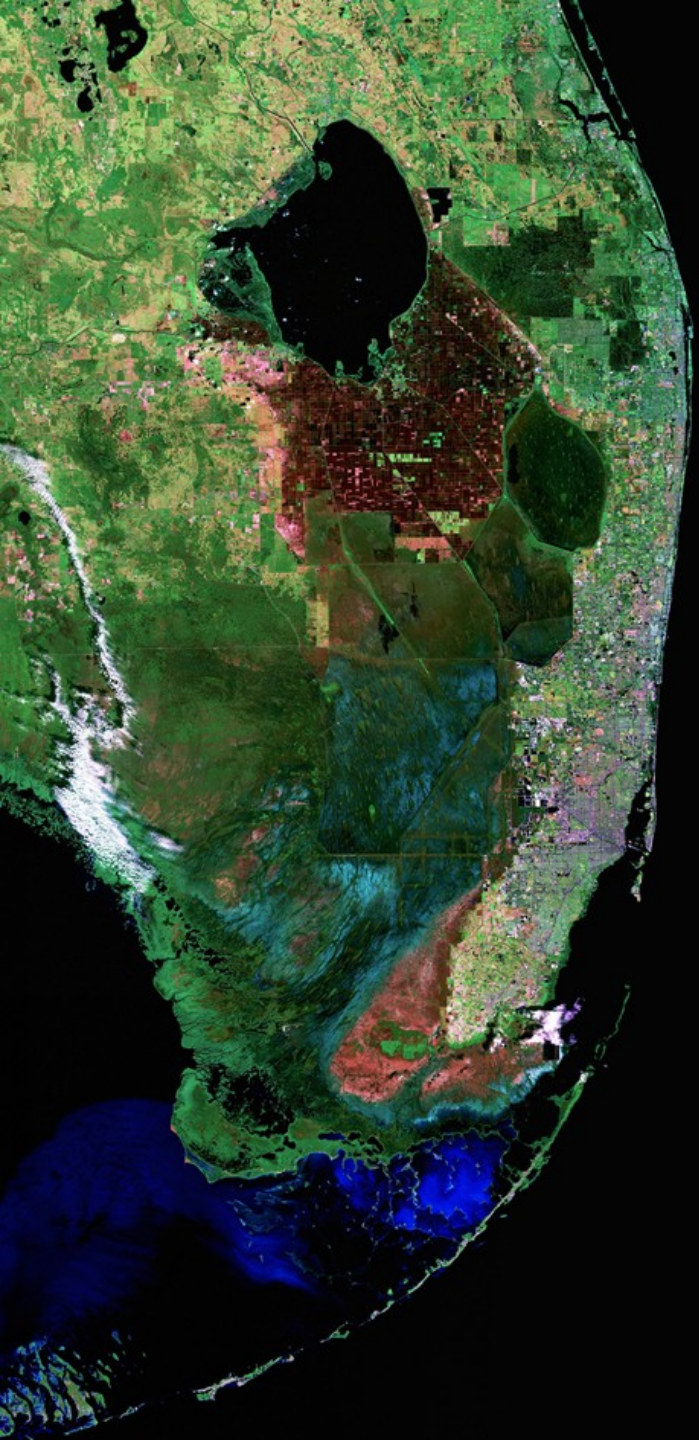


CLIMATE CHANGE

concerns for

EVERGLADES RESTORATION PLANNING

Planning Community of Practice Conference 2008

Presented by: Glenn Landers

U.S. Army Corps of Engineers, Jacksonville District

Everglades Restoration Goals

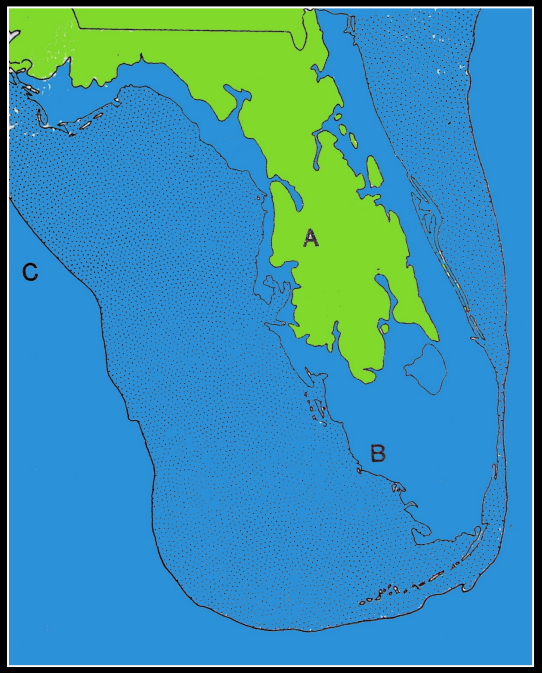
- Restore natural hydrologic conditions in the remaining Everglades
  - Water quantity, quality, timing and distribution
- Maintain existing services in developed areas
  - Flood Protection, Water Supply, and other (currently for 6.5 M people)

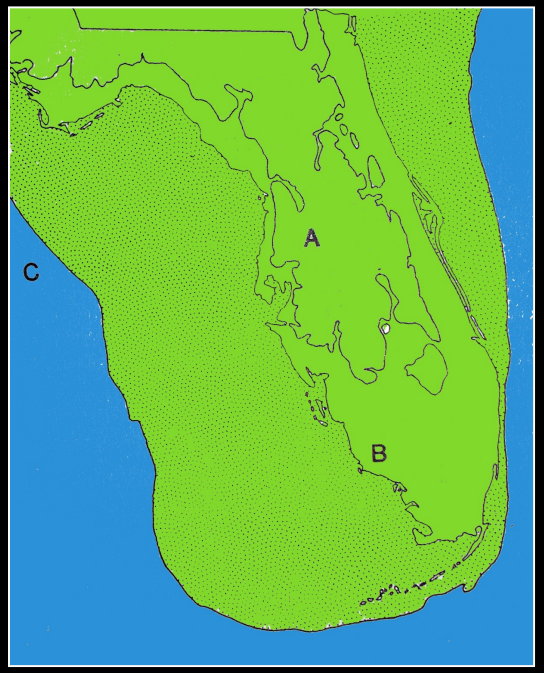
50% of historic

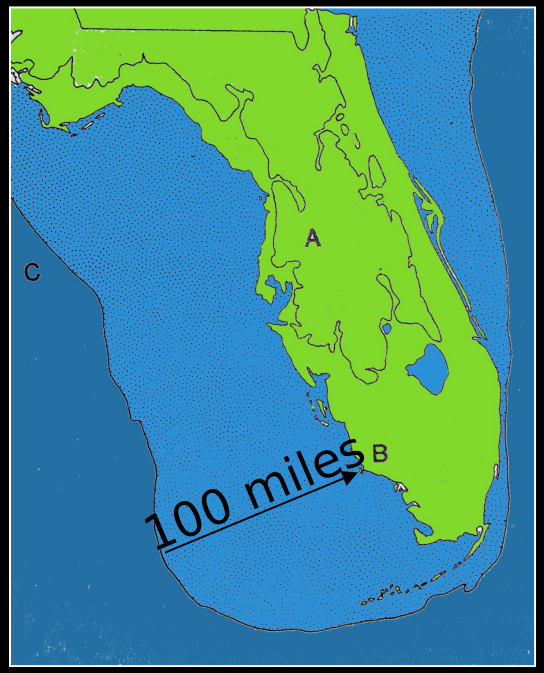
How Will Climate Change Impact Everglades Restoration?

- **Warmer Temperatures**
  - Evaporation losses up; water supply down
  - Stresses on plant, animal and marine ecosystems
  - Changes in growing season and migratory patterns
  - Changes in water quality
- **Hydrologic Pattern Changes**
  - Potential for less frequent and more intense rain events
  - Potential increased tropical storm intensity or frequency
- **Sea Level Rise**
  - Salinity changes in coastal bays
  - Shoreline retreat with natural habitat changes/losses
  - Increasing flooding in coastal areas
  - Saltwater intrusion in water supply wells
  - Uncertainties and RISKS in rate and depth of sea level rise

Florida Through Time – Climate Change Happens!







120,000 years ago 18,000 years ago Today

+ 6 meters (20’)* - 120 meters (420’)

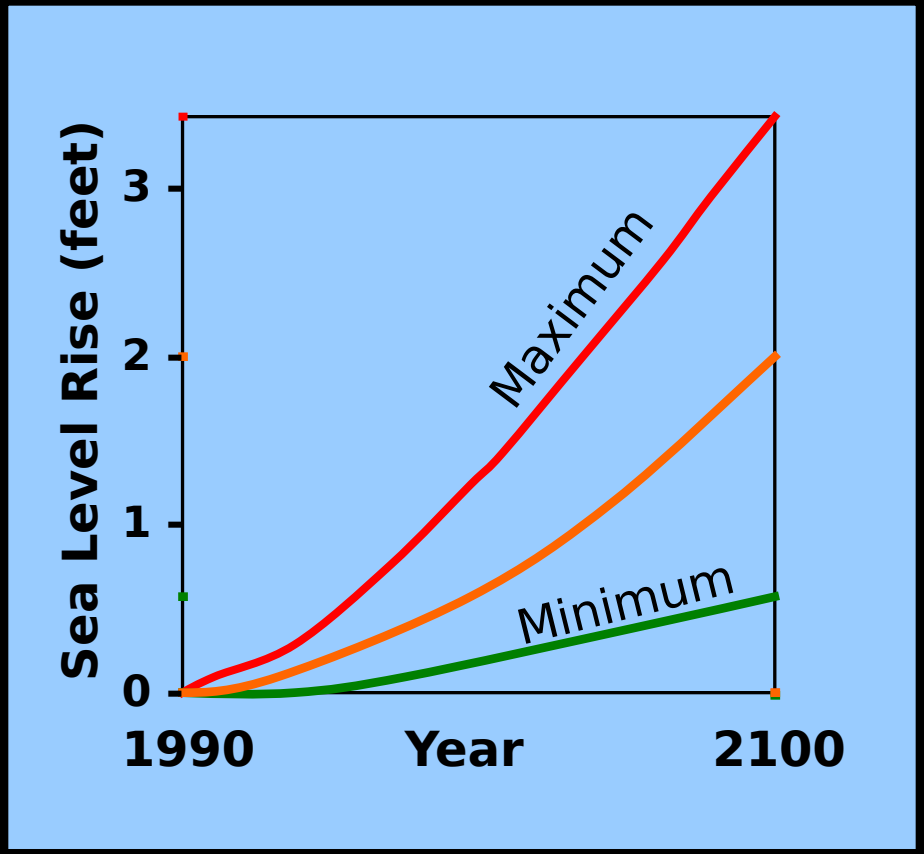
*~ ½ from Greenland

*~ ½ from Antarctica

Credit: **Dr. Harold R. Wanless; University of Miami, Department of Geological Sciences; co-chair of Miami-Dade Climate Change Task Force**

What is forecast for future sea level rise?

- The 2001 United Nations Intergovernmental Panel on Climate Change (IPCC) forecast ~ 2-ft rise in sea level by 2100
- The 2007 IPCC forecast was approximately the same at 7 – 23 inches
- These projections assume a gradual linear response of climate and sea level
- Scientists did not reach agreement on melting rates for glaciers and ice sheets in Greenland and Antarctica



IPCC, 2001

IPCC 2007
Projection For Coming Century

"Thermal expansion is projected to contribute more than half of the average rise, but land ice will lose mass increasingly rapidly as the century progresses."

"This [land ice melting] would add to the amount of sea level rise, but quantitative projections of how much it would add cannot be made with confidence, owing to limited understanding of the relevant processes."

Credit: Dr. Harold R. Wanless; University of Miami, Department of Geological Sciences; co-chair of Miami-Dade Climate Change Task Force

Scientists on the Miami-Dade Climate Change Advisory Task Force:

- "With what is happening in the Arctic and Greenland, [there will be] a likely sea level rise of **at least** 1.5 feet in the coming 50 years and a total of **at least** 3-5 feet by the end of the century, possibly significantly more. Spring high tides would be
at +7 to +9 feet."

- "This does not take into account the possibility of a catastrophically rapid melt of land-bound ice from Greenland, and it makes no assumptions about Antarctica."

- "The projected rises will just be the beginning because of further significant releases from Greenland and possibly Antarctica." *(September 20, 2007)*

Credit: **Dr. Harold R. Wanless; University of Miami, Department of Geological Sciences; co-chair of Miami-Dade Climate Change Task Force**

The answers to Florida's future lie in the Arctic

Since 2000,
the Arctic Ocean pack ice
and the Greenland Ice Sheet
have been rapidly falling apart

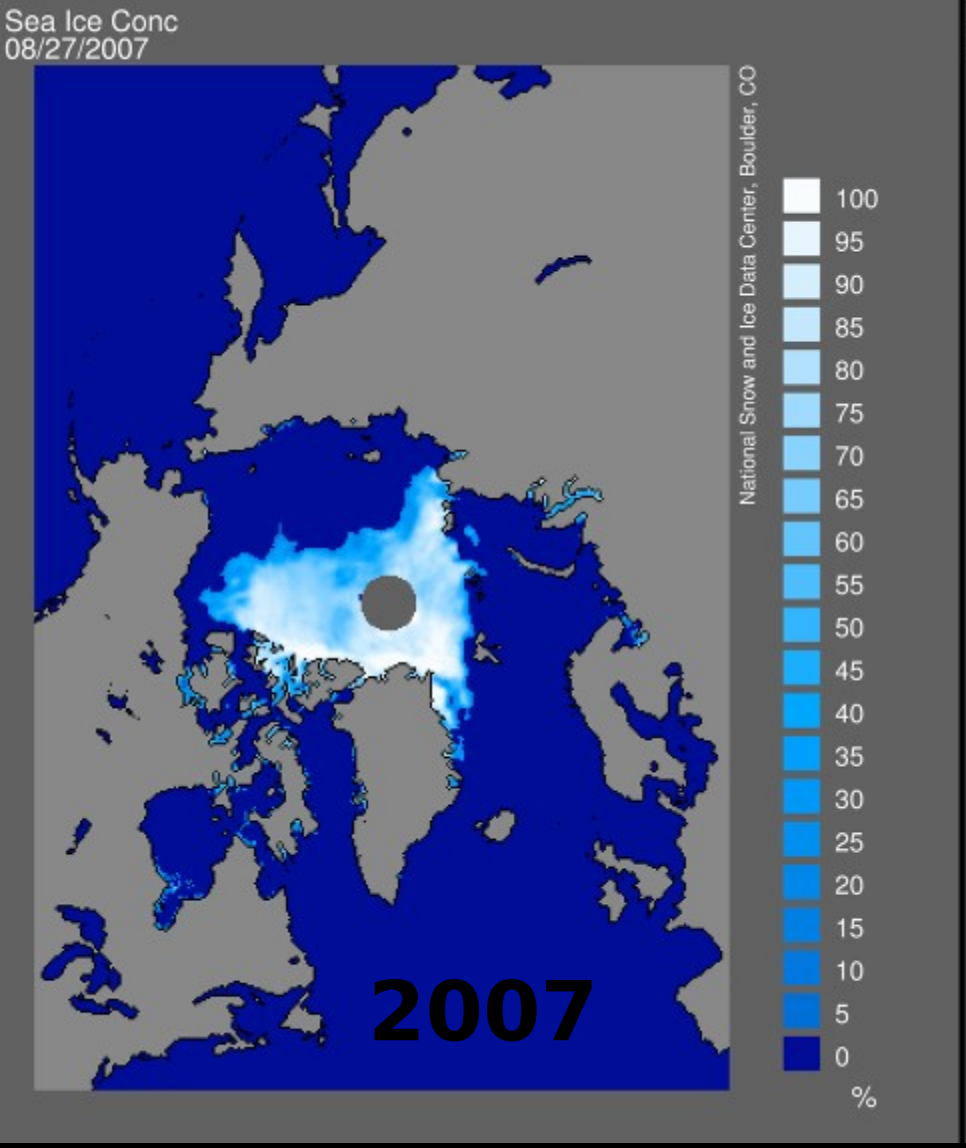
Credit: Dr. Harold R. Wanless; University of Miami, Department of Geological Sciences; co-chair of Miami-Dade Climate Change Task Force

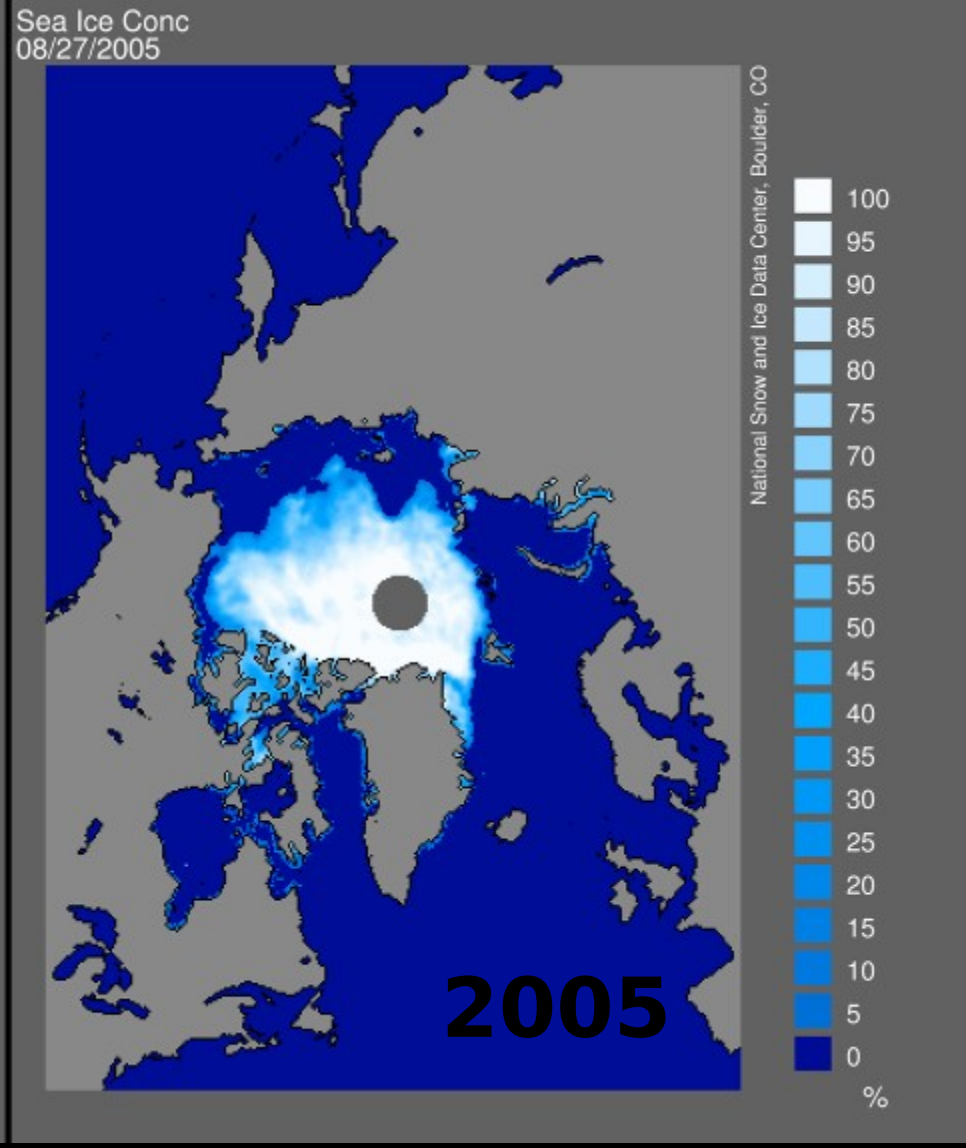
North Pole web cam – August 25, 2007

North Pole NetCam XL #4 Sat Aug 25 20:52:12 2007
Humidity: 39% Pressure: 1009.0mb Exposure: 1963
External Temp: -1.0°C Internal Temp: 10.5°C
Image © NOAA/PMEL

Credit: **Dr. Harold R. Wanless; University of Miami, Department of Geological Sciences; co-chair of Miami-Dade Climate Change Task Force**

Ice reflects nearly all incoming solar radiation back into the air and space. Open water absorbs over 90% of incoming solar radiation. With increasing open water, ice melts faster and sea levels rise faster.

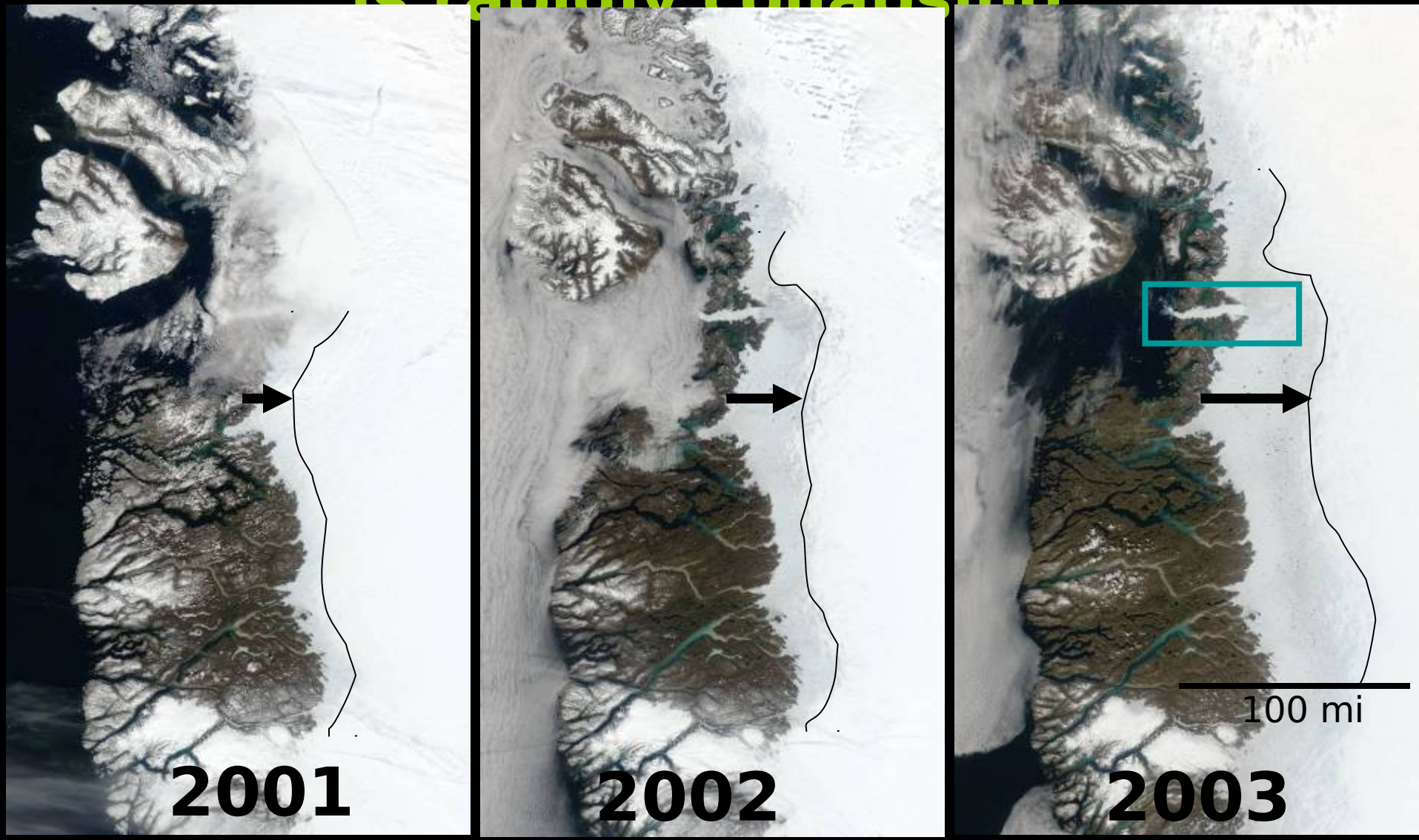




In 2007 the floating Arctic pack ice covered 33% less area than the previous record low in 2005. It is so thin and broken, it could easily just float out into the Atlantic.

Credit: **Dr. Harold R. Wanless; University of Miami, Department of Geological Sciences; co-chair of Miami-Dade Climate Change Task Force**

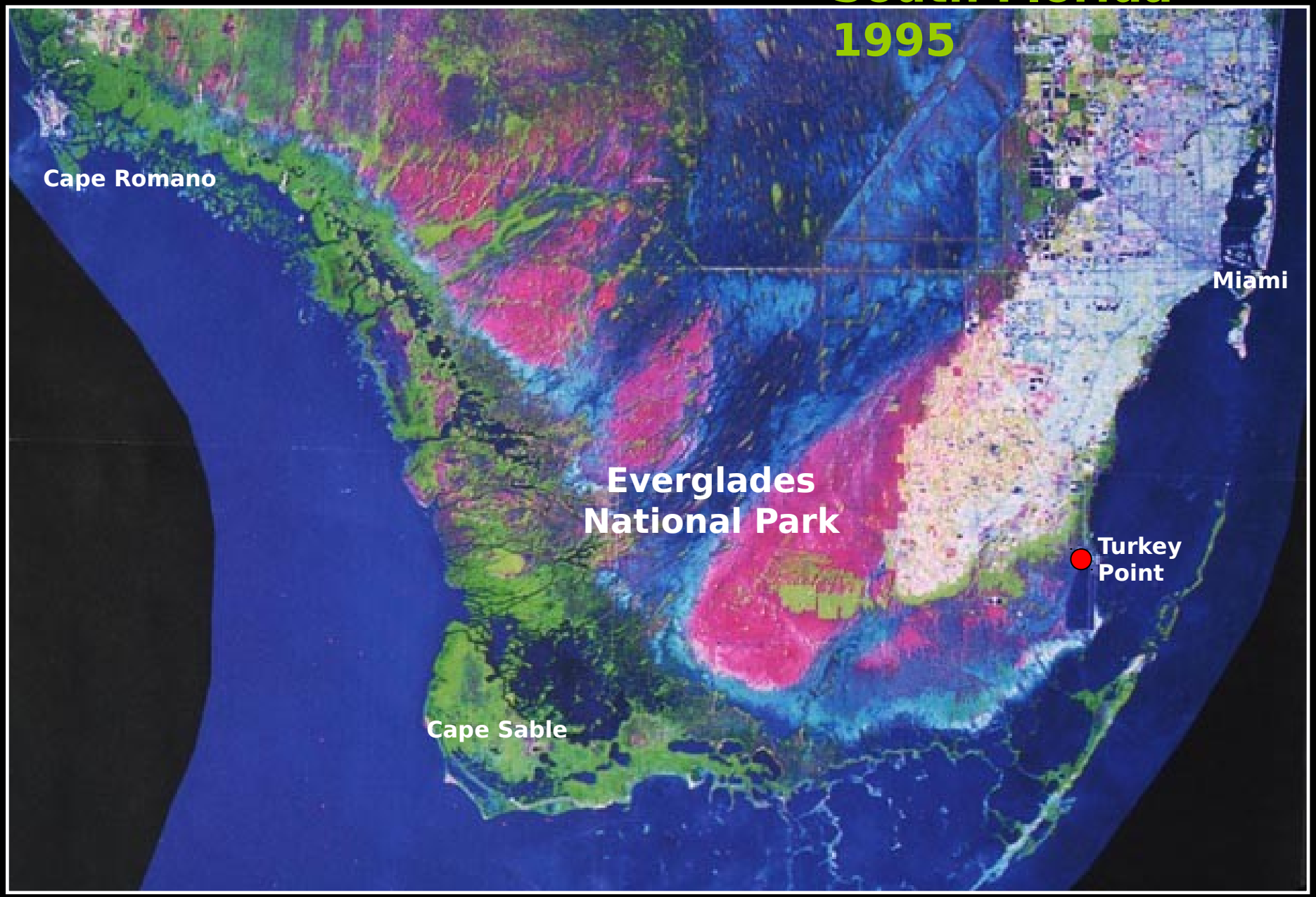
The margin of the Greenland ice sheet is rapidly collapsing



Credit: Dr. Harold R. Wanless; University of Miami, Department of Geological Sciences; co-chair of Miami-Dade Climate Change Task Force

- "Five years ago (2002) we made models predicting how much ice (Greenland Ice Sheet) would melt and when."
- "Five years later (2007) we are already at the levels predicted for 2040, in a year's time we'll be at 2050."
(Veli Albert Kallio, Finnish polar/ice scientist, September 8, 2007)

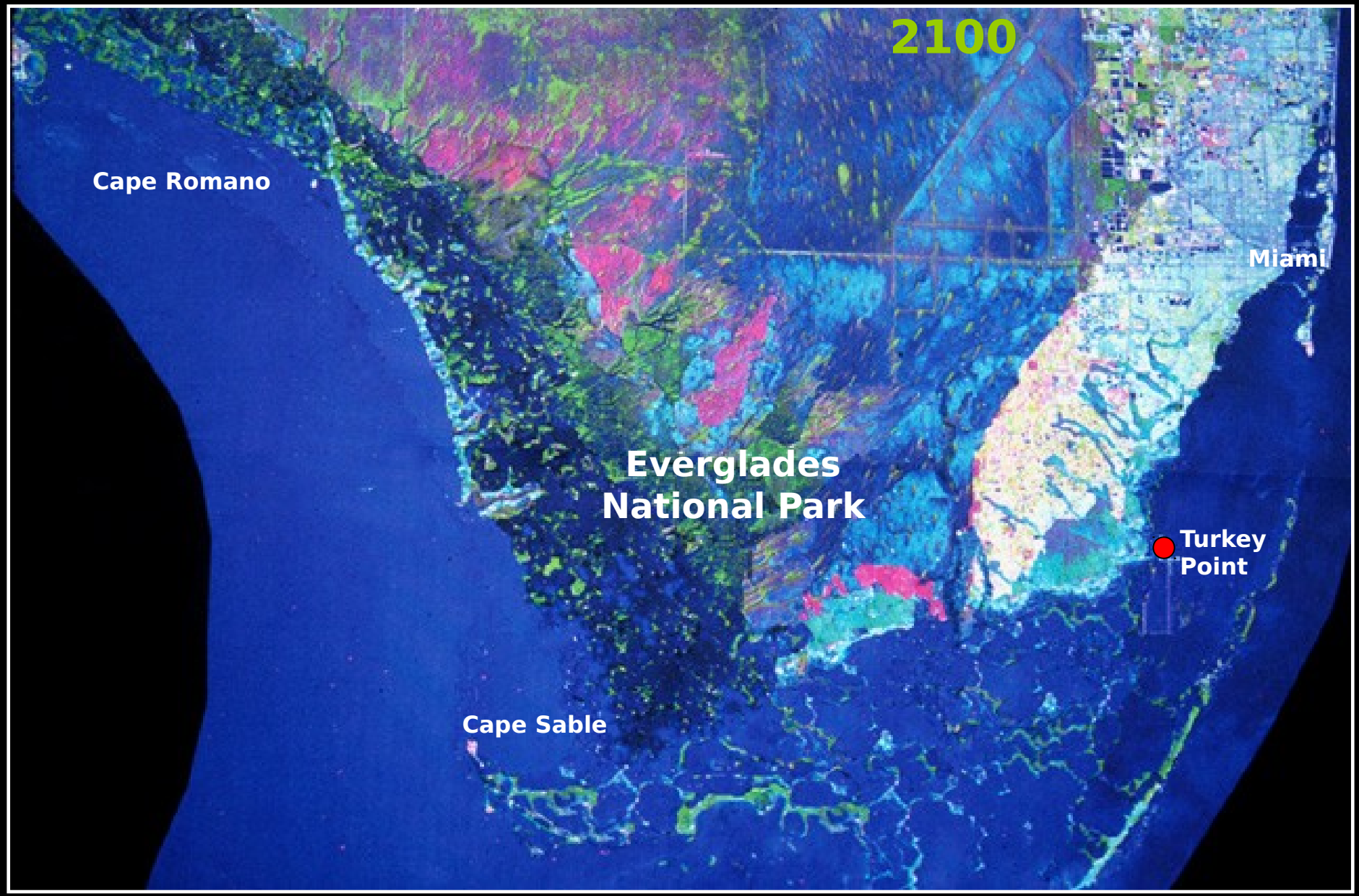
Credit: **Dr. Harold R. Wanless; University of Miami, Department of Geological Sciences; co-chair of Miami-Dade Climate Change Task Force**



Credit: Dr. Harold R. Wanless; University of Miami, Department of Geological Sciences; co-chair of Miami-Dade Climate Change Task Force

+2 foot rise (mhhw = +4.5’ above 1929 MSL)

South Florida 2100



Credit: Dr. Harold R. Wanless; University of Miami, Department of Geological Sciences; co-chair of Miami-Dade Climate Change Task Force

Everglades National Park (ENP)

- ENP is part of the Greater Everglades, a 100 mile long, 50 mile wide shallow, freshwater “River of Grass”
- The Greater Everglades is home to 69 threatened or endangered
  plants and animals
- At 1.5 million acres, the ENP is the largest wilderness area east of the Rocky Mountains
- ENP includes the largest freshwater sawgrass prairie in North America and the largest protected mangrove ecosystem in the western hemisphere
- 60% of ENP lands are less than 3 feet above MSL

Source: **Everglades National Park Superintendant, Dan Kimball; Congressional Sub-committee Testimony, April 26, 2007**

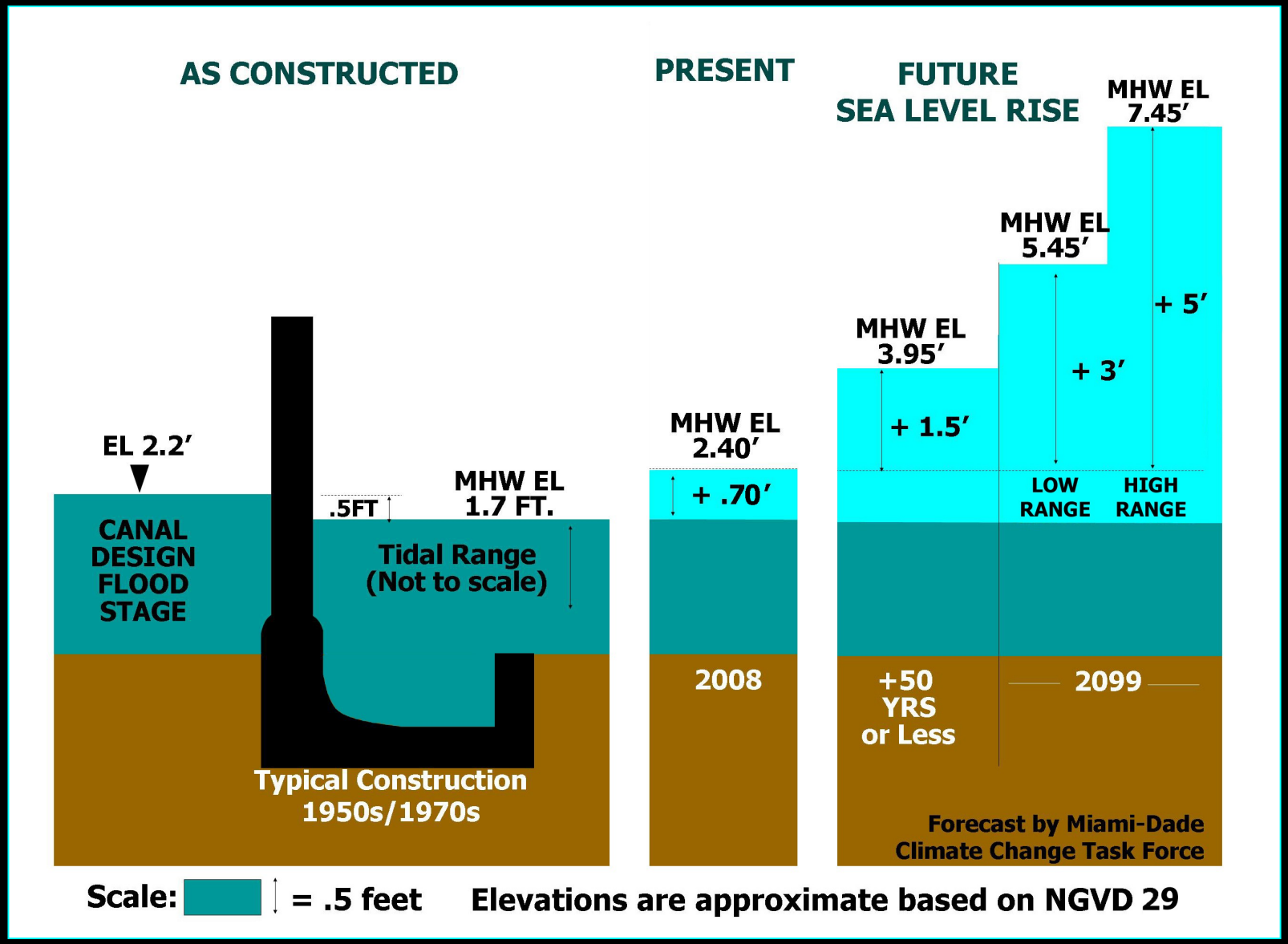
Saltwater inundation leads to peat collapse and decline of freshwater wetlands habitat

Photo Credit: Dr. Harold R. Wanless; University of Miami, Department of Geological Sciences; co-chair of Miami-Dade Climate Change Task

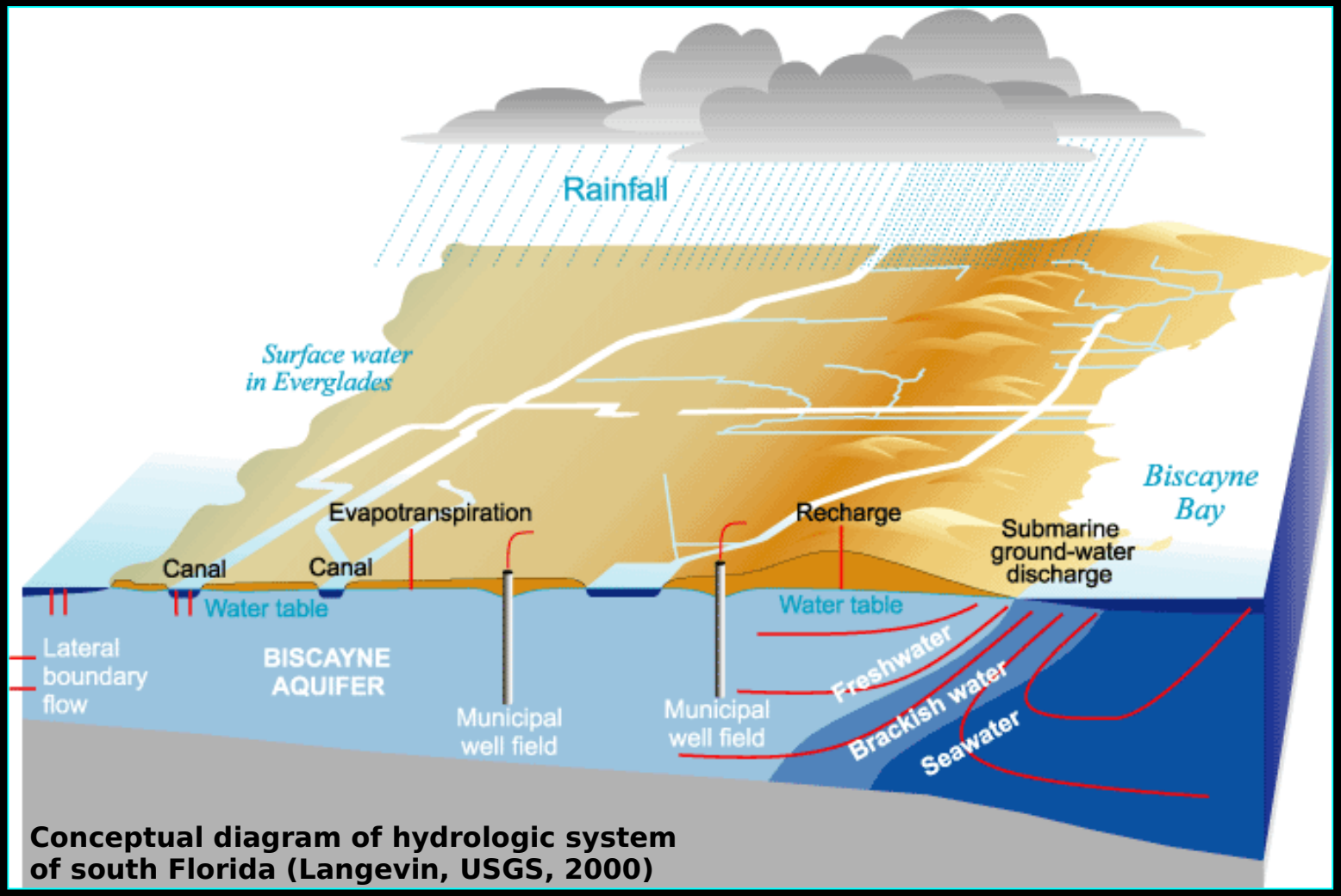
Everglades restoration will increase freshwater flows

delaying habitat changes due to future sea

The population of south Florida is 6.5 million and growing. Climate change and subsequent sea level rise will impact local
flood protection and water supplies.



Rising sea levels decrease the effectiveness of existing flood protection and increase the frequency and depth of flooding.



Conceptual diagram of hydrologic system of south Florida (Langevin, USGS, 2000)

- Shallow wells are the primary source of drinking water for south Florida communities. Continued sea level rise and related saltwater intrusion will create a need for alternative freshwater sources.
- Everglades restoration increases available freshwater supplies by

Everglades Restoration
Upcoming Actions Regarding Climate Change

- **Jul 08 Greater Everglades Ecosystem Restoration (GEER) Conference**
  - 4-day interagency Everglades science coordination meeting
  - Includes multiple workshop sessions on climate change
  - Information sharing via posters, papers and panel discussions
  - Identifies science studies needed to help guide Everglades restoration

- **Sep/Nov 08 National Academy of Sciences (NAS) Biennial Report to Congress on Everglades Restoration Progress**
  - May include strategic planning guidance for a wide range of potential climate change impacts
  - Expect guidance on future rate and depth of sea level rise
  - Expect comments on existing USACE planning guidance for sea level rise (developed from 1987 NAS/NRC guidance)

Everglades Restoration
Upcoming Actions Regarding Climate Change

- **Dec 08 SE Region Interagency Climate Change meeting**
  - Sponsored by SE region federal natural resource agencies
  - Information sharing and coordination with states and others
- **FY09 Everglades Sea Level Rise Sensitivity Analysis**
  - Use new coastal areas digital topography from FEMA National Flood Insurance Program
  - Update water management datum - NGVD29 to NAVD88
  - Identify flooding risks for a range of rising sea levels
  - Identify water supply wells and saltwater intrusion risks
  - Identify impacts to natural areas and species of concern
  - Develop scope of work for additional studies and other actions
  - Information sharing with others for strategic planning

Everglades Restoration Climate Change Concerns

Key Take-a-Way Points

Restoration of the Greater Everglades "...is even more critical in a time of rising seas."

Testimony to Congress
ENP Superintendant Dan Kimball
April 26, 2007

Everglades Restoration Climate Change Concerns

Key Take-a-Way Points

- Large uncertainties and RISKS exist regarding climate change, particularly future rate and depth of sea level rise

- National Academy of Sciences expected to provide guidance in Fall 08 on future rate and depth of sea level rise (IPCC versus Miami-Dade forecasts)

- Everglades Restoration will help delay climate change impacts in natural and developed areas

Everglades Restoration Climate Change Concerns

Key Take-a-Way Points

- Update USACE planning guidance to address impacts/costs of climate change on developed and natural areas

- Review USACE regulatory policy to consider climate change and related future costs of permitting decisions for areas subject to sea level rise

- Develop coordinated federal/state plan for buy-outs of areas subject to sea level rise

For additional information, contact:

Glenn Landers
U.S. Army Corps of Engineers
Jacksonville District

Glenn.B.Landers@usace.army.mil